

Application/Control Number: 10/815,880

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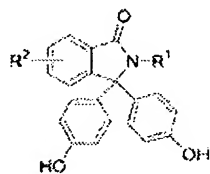
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1. A method for producing a 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine, comprising:

forming a reaction mixture comprising at least one substituted or unsubstituted phenolphthalein, at least one substituted or unsubstituted primary hydrocarbyl amine, and an acid catalyst; and

heating the reaction mixture to a temperature of less than 180 °C to remove a distillate comprising water and form a crude 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine product;

wherein said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine has a formula:



wherein R¹ is selected from the group consisting of a hydrogen and a hydrocarbyl group, and R² is selected from the group consisting of a hydrogen, a hydrocarbyl group, and a halogen.

2. The method of Claim 1, wherein said crude PPPBP product is at least 97.5 area percent pure 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine.

3. The method of Claim 1, wherein said crude PPPBP product is at least 98 area percent pure 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine.

4. The method of Claim 1, further comprising:

dissolving said crude 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine product in an aqueous base to provide a first solution;

treating and filtering said first solution with a solid adsorbent to provide a second solution; and

treating said second solution with an aqueous acid to precipitate said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine.
5. The method of Claim 4, wherein said treating and filtering is done at least 2 times.
6. The method of Claim 4, wherein said aqueous base comprises an alkali metal or alkaline earth metal hydroxide, carbonate, or bicarbonate.
7. The method of Claim 4, wherein said adsorbent comprises an activated carbon.
8. The method of Claim 4, wherein said treating and filtering said first solution is effective to reduce an amount of 2-hydrocarbyl-3-((4-hydroxyaryl)(2-hydroxyaryl))phthalimidine to less than or equal to 1,000 parts per million relative to an overall weight of the 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine.
9. The method of Claim 1, further comprising contacting said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine with an aliphatic alcohol to produce a purified 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine comprising less than or equal to 1,000 parts per million of a substituted or an unsubstituted phenolphthalein relative to an overall weight of said purified 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine.
10. The method of Claim 9, wherein said aliphatic alcohol comprises methanol, ethanol, iso-propanol, iso-butanol, n-butanol, tertiary butanol, n-pentanol, iso-pentanol, cyclohexanol, ethylene glycol, propylene glycol, neopentyl glycol or mixtures of the foregoing aliphatic alcohols.

11. The method of Claim 1, wherein said acid catalyst is selected from a group consisting of a substituted or an unsubstituted aliphatic amine hydrochloride, an aromatic amine hydrochloride, or mixtures of the foregoing amine hydrochlorides.

12. The method of Claim 1, wherein said heating the reaction mixture comprises heating to a temperature of about 150°C to about 175°C.

13. The method of Claim 1, wherein said heating the reaction mixture comprises heating to a temperature of about 150°C to about 170°C.

14. The method of Claim 1, wherein said heating the reaction mixture is for a time of about 12 hours to about 20 hours.

15. A purified 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine prepared in accordance with the method of Claim 1.

16. The purified 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine of Claim 15, comprising less than or equal to 1,000 parts per million of a 2-hydrocarbyl-3-((4-hydroxyaryl)(2-hydroxyaryl))phthalimidine, relative to an overall weight of said purified 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine.

17. The method of Claim 1, wherein said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine is 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine.

18. The method of Claim 17, wherein said 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine comprises less than or equal to 1,000 parts per million of a 2-phenyl-3-((4-hydroxyphenyl)(2-hydroxyphenyl))phthalimidine relative to an overall weight of said 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine.

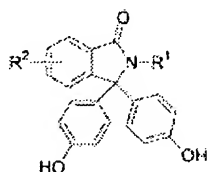
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19. A method for purifying a crude 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine, comprising:

dissolving the crude 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine product in an aqueous base to provide a first solution;

treating said first solution with an activated carbon and filtering to provide a second solution; and

treating said second solution with an aqueous acid to precipitate a purified 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine of formula:

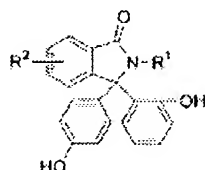


wherein R¹ is selected from the group consisting of a hydrogen and a hydrocarbyl group, and R² is selected from the group consisting of a hydrogen, a hydrocarbyl group, and a halogen, wherein said purified 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine comprises less than or equal to 1,000 parts per million of a 2-hydrocarbyl-3-((4-hydroxyaryl)(2-hydroxyaryl))phthalimidine relative to an overall weight of said purified 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine.

20. The method of Claim 19, wherein said treating said first solution with an activated carbon and filtering to provide a second solution is done at least 2 times.

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21. A 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine comprising less than or equal to 1,000 parts per million of a 2-hydrocarbyl-3-((4-hydroxyaryl)(2-hydroxyaryl))phthalimidine relative to an overall weight of said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine, wherein said 2-hydrocarbyl-3-((4-hydroxyaryl)(2-hydroxyaryl))phthalimidine has a formula of:



wherein R^1 is selected from the group consisting of a hydrogen and a hydrocarbyl group, and R^2 is selected from the group consisting of a hydrogen, a hydrocarbyl group, and a halogen.

22. The 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine of Claim 21, further comprising less than or equal to 1,000 parts per million of a substituted or an unsubstituted phenolphthalein relative to an overall weight of said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine

23. A 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine comprising less than or equal to 1,000 parts per million of 2-phenyl-3-((4-hydroxyphenyl)(2-hydroxyphenyl))phthalimidine, relative to an overall weight of said 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine.

24. The 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine of Claim 23, further comprising less than or equal to about 1000 parts per million of phenolphthalein relative to an overall weight of said 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine.

25. A polymer composition comprising structural units derived from the 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine of Claim 21.

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26. A polymer composition comprising structural units derived from the 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine of Claim 23.

27. The polymer composition of Claim 26, wherein said polymer is selected from the group consisting of homopolymers and copolymers of a polycarbonate, a polyestercarbonate, a polyester, a polyesteramide, a polyimide, a polyetherimide, a polyamideimide, a polyether, a polyethersulfone, a polycarbonate - polyorganosiloxane block copolymer, a copolymer comprising aromatic ester, estercarbonate, and carbonate repeat units; and a polyetherketone.

28. A polymer blend comprising at least one thermoplastic polymer and the polycarbonate of Claim 27.

29. The polymer blend of Claim 28, wherein said at least one thermoplastic polymer is selected from the group consisting of vinyl polymers, acrylic polymers, polyacrylonitrile, polystyrenes, polyolefins, polyesters, polyurethanes, polyamides, polysulfones, polyimides, polyetherimides, polyphenylene ethers, polyphenylene sulfides, polyether ketones, polyether ether ketones, ABS resins, polyethersulfones, poly(alkenylaromatic) polymers, polybutadiene, polyacetals, polycarbonates, polyphenylene ethers, ethylene-vinyl acetate copolymers, polyvinyl acetate, liquid crystal polymers, ethylene-tetrafluoroethylene copolymer, aromatic polyesters, polyvinyl fluoride, polyvinylidene fluoride, polyvinylidene chloride, tetrafluoroethylene, polycarbonate - polyorganosiloxane block copolymers, copolymers comprising aromatic ester, estercarbonate, and carbonate repeat units mixtures, and blends comprising at least one of the foregoing polymers.

30. An article comprising the polymer composition of Claim 25.

31. An article comprising the polymer composition of Claim 26.

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32. A method for producing a polycarbonate comprising structural units derived from a 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine, wherein said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine comprises less than or equal to 1,000 parts per million of a 2-hydrocarbyl-3-((4-hydroxyaryl)(2-hydroxyaryl))phthalimidine impurity relative to an overall weight of said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine, wherein the method is selected from the group consisting of a melt transesterification polymerization method, and an interfacial polymerization method.

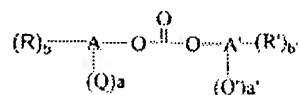
33. The method of Claim 32, wherein said melt transesterification polymerization comprises:

forming a reaction mixture comprising a catalyst and a reactant composition, wherein the reactant composition comprises a carbonic acid diester and the 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine, wherein the carbonic acid diester is of the formula $(ZO)_2C=O$, where each Z is independently an unsubstituted or a substituted alkyl radical, or an unsubstituted or a substituted aryl radical; and

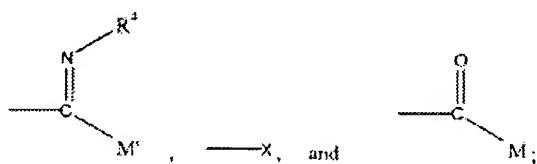
mixing the reaction mixture under reactive conditions for a time effective to produce a polycarbonate product.

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34. The method of Claim 33, wherein said carbonic acid diester comprises an activated aromatic carbonate having the formula:



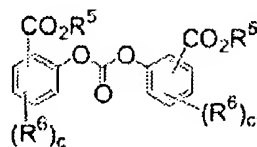
wherein Q and Q' are each independently activating groups selected from the group of radicals consisting of (alkoxycarbonyl)aryl groups, halogens, nitro groups, amide groups, sulfone groups, sulfoxide groups, or imine groups with structures:



wherein X comprises halogen or NO₂; M and M' independently comprises N-alkyl, N-aryl, or N-alkyl aryl; R⁴ comprises alkyl or aryl; A and A' are each independently aromatic rings; a and a' can be zero to whole numbers of up to a maximum equivalent to the number of replaceable hydrogen groups substituted on the aromatic rings A and A' respectively, provided a + a' is greater than or equal to 1; R and R' are each independently substituent groups selected from the group consisting of alkyl, cycloalkyl, alkoxy, aryl, cyano, nitro, and halogen; b is zero to a whole number up to a maximum equivalent to the number of replaceable hydrogen groups on the aromatic ring A minus a; and b' is zero to a whole number up to a maximum equivalent to the number of replaceable hydrogen groups on the aromatic ring A' minus a'.

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35. The method of Claim 33, wherein the carbonic acid diester is an ester-substituted diaryl carbonate of formula:



wherein R^5 is independently at each occurrence selected from the group consisting of an $\text{C}_1 - \text{C}_{20}$ alkyl radical, a $\text{C}_4 - \text{C}_{20}$ cycloalkyl radical, and a $\text{C}_6 - \text{C}_{20}$ aromatic radical; R^6 is independently at each occurrence selected from the group consisting of a halogen, a cyano group, a nitro group, a $\text{C}_1 - \text{C}_{20}$ alkyl radical, a $\text{C}_4 - \text{C}_{20}$ cycloalkyl radical, a $\text{C}_6 - \text{C}_{20}$ aromatic radical, a $\text{C}_1 - \text{C}_{20}$ alkoxy radical, a $\text{C}_4 - \text{C}_{20}$ cycloalkoxy radical, a $\text{C}_6 - \text{C}_{20}$ aryloxy radical, a $\text{C}_1 - \text{C}_{20}$ alkylthio radical, a $\text{C}_4 - \text{C}_{20}$ cycloalkylthio radical, a $\text{C}_6 - \text{C}_{20}$ arylthio radical, a $\text{C}_1 - \text{C}_{20}$ alkylsulfinyl radical, a $\text{C}_4 - \text{C}_{20}$ cycloalkylsulfinyl radical, a $\text{C}_6 - \text{C}_{20}$ arylsulfinyl radical, a $\text{C}_1 - \text{C}_{20}$ alkylsulfonyl radical, a $\text{C}_4 - \text{C}_{20}$ cycloalkylsulfonyl radical, a $\text{C}_6 - \text{C}_{20}$ arylsulfonyl radical, a $\text{C}_1 - \text{C}_{20}$ alkoxy carbonyl radical, a $\text{C}_4 - \text{C}_{20}$ cycloalkoxy carbonyl radical, a $\text{C}_6 - \text{C}_{20}$ aryloxy carbonyl radical, a $\text{C}_2 - \text{C}_{40}$ alkylamino radical, a $\text{C}_6 - \text{C}_{40}$ cycloalkylamino radical, a $\text{C}_6 - \text{C}_{40}$ arylamino radical, a $\text{C}_1 - \text{C}_{40}$ alkylaminocarbonyl radical, a $\text{C}_4 - \text{C}_{40}$ cycloalkylaminocarbonyl radical, a $\text{C}_6 - \text{C}_{40}$ arylaminocarbonyl radical, and a $\text{C}_1 - \text{C}_{20}$ acylamino radical; and c is independently at each occurrence is zero to a whole number to 4.

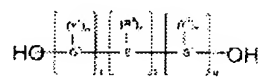
36. The method of Claim 33, wherein the carbonic acid diester is a bismethylsalicyl carbonate.

37. The method of Claim 33, wherein the reactive conditions comprises mixing the reactant mixture at a temperature and a pressure that are stepwise raised from a first step comprising a melting temperature of about 190°C and a first pressure; a second step of about 190°C to about 210°C at a second pressure; a third step of about 210°C to about 310°C at a third pressure; and a fourth step of about 310°C at a fourth pressure.

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38. The method of Claim 37, wherein said first pressure is at about ambient pressure, second pressure is at about an ambient pressure to about 100 millibars, said third pressure is at about 100 millibars to less than or equal to about 1 millibar, and said fourth pressure is at less than or equal to about 1 millibar.

39. The method of Claim 33, wherein said reactant composition further comprises at least one aromatic dihydroxy compound of the formula:



wherein each G^1 is an independently aromatic group; E is selected from the group consisting of an alkylene group, an alkylidene group, a cycloaliphatic group, a sulfur-containing linkage group, a phosphorus-containing linkage group, an ether linkage group, a carbonyl group, a tertiary nitrogen group, and a silicon-containing linkage group; R^1 is a hydrogen or a monovalent hydrocarbon group each; Y^1 is independently selected from the groups consisting of a monovalent hydrocarbyl group, an alkenyl group, an allyl group, a halogen, an oxy group and a nitro group; each m is independently a whole number from zero through the number of positions on each respective G^1 available for substitution; p is a whole number from zero through the number of positions on E available for substitution; t is a natural number greater than or equal to one; s is either zero or one; and u is a whole number.

40. The method of Claim 39, wherein the at least one aromatic dihydroxy compound is selected from the group consisting of 4,4'-(3,3,5-trimethylcyclohexylidene)diphenol, 4,4'-bis(3,5-dimethyl)diphenol, 1,1-bis(4-hydroxy-3-methylphenyl)cyclohexane, 1,1-bis(4'-hydroxy-3-methylphenyl)cyclohexane, 4,4'-[1-methyl-4-(1-methylethyl)-1,3-cyclohexadiyl]bisphenol, 4-[1-[3-(4-hydroxyphenyl)-4-methylcyclohexyl]-1-methylethyl]-phenol, 3,8-dihydroxy-5a,10b-diphenylcoumarano-2',3',2,3-coumarane, 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine, 4,4-bis(4-hydroxyphenyl)heptane, 2,4'-dihydroxydiphenylmethane, bis(2-hydroxyphenyl)methane, bis(4-hydroxyphenyl)methane, bis(4-hydroxy-5-nitrophenyl)methane, bis(4-hydroxy-2,6-

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dimethyl-3-methoxyphenyl)methane, 1,1-bis(4-hydroxyphenyl)ethane, 1,1-bis(4-hydroxy-2-chlorophenyl)ethane, 2,2-bis(4-hydroxyphenyl)propane, 2,2-bis(3-phenyl-4-hydroxyphenyl)propane, 2,2-bis(4-hydroxy-3-methylphenyl)propane, 2,2-bis(4-hydroxy-3-ethylphenyl)propane, 2,2-bis(4-hydroxy-3-isopropylphenyl)propane, 2,2-bis(4-hydroxy-3,5-dimethylphenyl)propane, 2,2-bis(3,5,3',5'-tetrachloro-4,4'-dihydroxyphenyl)propane, bis(4-hydroxyphenyl)cyclohexylmethane, 2,2-bis(4-hydroxyphenyl)-1-phenylpropane, 2,4'-dihydroxyphenyl sulfone, 4,4'-dihydroxydiphenylsulfone, 9,9-bis(4-hydroxyphenyl)fluorene, 4,4'-dihydroxy-1,1'-biphenyl, 2,6-dihydroxy naphthalene, hydroquinone, resorcinol, C₁₋₃ alkyl-substituted resorcinols, 3-(4-hydroxyphenyl)-1,1,3-trimethylindan-5-ol, 1-(4-hydroxyphenyl)-1,3,3-trimethylindan-5-ol, and 2,2,2',2'-tetrahydro-3,3,3',3'-tetramethyl-1,1'-spirobi[1H-indene]-6,6'-diol.

41. The method of Claim 33, wherein the catalyst comprises:

an alpha catalyst selected from the group consisting of alkali metal salts and alkaline earth metal salts; and

a beta catalyst selected from the group consisting of a quaternary ammonium compound and a quaternary phosphonium compound.

42. The method of Claim 32, wherein said interfacial polymerization comprises reacting in a two-phase medium, a monomer mixture comprising said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine and phosgene in the presence of an acid acceptor and an aqueous base to produce said polycarbonate.

43. The method of Claim 42, wherein said polycarbonate has a weight average molecular weight from about 40,000 Daltons to about 75,000 Daltons, relative to a polystyrene standard.

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dimethyl-3-methoxyphenyl)methane, 1,1-bis(4-hydroxyphenyl)ethane, 1,1-bis(4-hydroxy-2-chlorophenyl)ethane, 2,2-bis(4-hydroxyphenyl)propane, 2,2-bis(3-phenyl-4-hydroxyphenyl)propane, 2,2-bis(4-hydroxy-3-methylphenyl)propane, 2,2-bis(4-hydroxy-3-ethylphenyl)propane, 2,2-bis(4-hydroxy-3-isopropylphenyl)propane, 2,2-bis(4-hydroxy-3,5-dimethylphenyl)propane, 2,2-bis(3,5,3',5'-tetrachloro-4,4'-dihydroxyphenyl)propane, bis(4-hydroxyphenyl)cyclohexylmethane, 2,2-bis(4-hydroxyphenyl)-1-phenylpropane, 2,4'-dihydroxyphenyl sulfone, 4,4'-dihydroxydiphenylsulfone, 9,9-bis(4-hydroxyphenyl)fluorene, 4,4'-dihydroxy-1,1'-biphenyl, 2,6-dihydroxy naphthalene, hydroquinone; resorcinol, C_{1-3} alkyl-substituted resorcinols, 3-(4-hydroxyphenyl)-1,1,3-trimethylindan-5-ol, 1-(4-hydroxyphenyl)-1,3,3-trimethylindan-5-ol, and 2,2,2',2'-tetrahydro-3,3,3',3'-tetramethyl-1,1'-spirobi[1H-indene]-6,6'-diol.

41. The method of Claim 33, wherein the catalyst comprises:

an alpha catalyst selected from the group consisting of alkali metal salts and alkaline earth metal salts; and

a beta catalyst selected from the group consisting of a quaternary ammonium compound and a quaternary phosphonium compound.

42. The method of Claim 32, wherein said interfacial polymerization comprises reacting in a two-phase medium, a monomer mixture comprising said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine and phosgene in the presence of an acid acceptor and an aqueous base to produce said polycarbonate.

43. The method of Claim 42, wherein said polycarbonate has a weight average molecular weight from about 40,000 Daltons to about 75,000 Daltons, relative to a polystyrene standard.

44. An article comprising the polycarbonate prepared in accordance with the method of Claim 42.

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45. The article of Claim 44, wherein said article has a yellowness index of less than or equal to about 10, as measured on a 3 millimeter thick plaque in accordance with ASTM D1925.

46. The method of Claim 32, wherein said interfacial polymerization method comprises:

reacting phosgene with a monomer mixture comprising said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine in an organic solvent to form a 2-hydrocarbyl-3,3-bis((4-chloroformyl)aryl)phthalimidine; and

reacting said 2-hydrocarbyl-3,3-bis((4-chloroformyl)aryl)phthalimidine with an aromatic dihydroxy compound or said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine in the presence of an acid acceptor and an aqueous base.

47. The method of Claim 32, wherein said interfacial polymerization method comprises:

introducing into a tubular reactor system phosgene, at least one solvent, at least one bisphenol, caustic, and optionally one or more catalysts, thereby forming a flowing reaction mixture;

passing said flowing reaction mixture through said tubular reactor system until substantially all of the phosgene has been consumed;

introducing into said flowing reaction mixture in which substantially all of the phosgene has been consumed, caustic, at least one end-capping agent, and at least one catalyst to form an end-capped polycarbonate; and

removing said end-capped polycarbonate from said reactor system.

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48. A melt transesterification polymerization method comprising:

combining a catalyst and a reactant composition to form a reaction mixture, wherein the reactant composition comprises a carbonic acid diester, a 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine, and at least one aromatic dihydroxy compound comonomer, wherein the carbonic acid diester is of the formula $(ZO)_2C=O$, wherein each Z is independently an unsubstituted or substituted alkyl radical, or an unsubstituted or substituted acyl radical, and, wherein said 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine comprises less than or equal to 1,000 parts per million of 2-phenyl-3-((4-hydroxyphenyl)(2-hydroxyphenyl))phthalimidine relative to an overall weight of said 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine; and

mixing the reaction mixture under reactive conditions for a time period to produce a polycarbonate product.

49. The method of Claim 48, wherein said carbonic acid diester comprises diphenyl carbonate or bis(methylsaliyl) carbonate.

50. The method of Claim 48, wherein said at least one aromatic dihydroxy compound is selected from the group consisting of 4,4'-(3,3,5-trimethylcyclohexylidene)diphenol, 4,4'-bis(3,5-dimethyl)diphenol, 1,1-bis(4-hydroxy-3-methylphenyl)cyclohexane, 4,4-bis(4-hydroxyphenyl)heptane, 2,4'-dihydroxydiphenylmethane, bis(2-hydroxyphenyl)methane, bis(4-hydroxyphenyl)methane, bis(4-hydroxy-5-nitrophenyl)methane, bis(4-hydroxy-2,6-dimethyl-3-methoxyphenyl)methane, 1,1-bis(4-hydroxyphenyl)ethane, 1,3-bis(4-hydroxy-2-chlorophenyl)ethane, 2,2-bis(4-hydroxyphenyl)propane, 2,2-bis(3-phenyl-4-hydroxyphenyl)propane, 2,2-bis(4-hydroxy-3-methylphenyl)propane, 2,2-bis(4-hydroxy-3-ethylphenyl)propane, 2,2-bis(4-hydroxy-3-isopropylphenyl)propane, 2,2-bis(4-hydroxy-3,5-dimethylphenyl)propane, 2,2-bis(3,5,3',5'-tetrachloro-4,4'-dihydroxyphenyl)propane, bis(4-hydroxyphenyl)cyclohexylmethane, 2,2-bis(4-hydroxyphenyl)-1-phenylpropane, 2,4'-dihydroxyphenyl sulfone, 2,6-dihydroxy naphthalene, hydroquinone, C_{1-3} alkyl-substituted resorcinols, 3-(4-hydroxyphenyl)-1,1,3-trimethylindan-5-ol, 1-(4-hydroxyphenyl)-1,3,3-trimethylindan-5-ol, 2,2,2',2'-tetrahydro-3,3,3',3'-tetramethyl-1,1'-spirobi[1H-indene]-6,6'-diol, resorcinol, 4,4'-(1-decylidene)-bisphenol, 2,2-bis(3-sec-butyl-4-hydroxyphenyl)propane, and combinations comprising at least one of the foregoing aromatic dihydroxy compounds.

51. The method of Claim 48, wherein said at least one aromatic dihydroxy compound comonomer is bisphenol A.

52. The method of Claim 48, wherein said catalyst composition is 1×10^{-2} to about 2×10^{-3} moles for each mole of said reactant composition.

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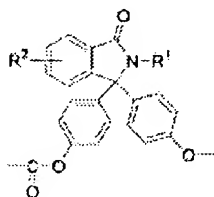
53. The method of Claim 48, wherein the reaction conditions comprises mixing said reaction mixture at a temperature that is stepwise raised from a first step comprising a melting temperature of about 180°C; a second step of about 180°C to about 230°C; a third step of about 230°C to about 270°C; and a fourth step of about 270°C to about 320 °C.

54. The method of Claim 48, wherein said carbonic acid diester comprises a mole ratio of about 0.8 to about 1.30 relative to a total amount of moles of said 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine and said at least one aromatic dihydroxy compound comonomer.

55. The method of Claim 48, wherein said reactant composition further comprises 1,4:3,6-dianhydro-D-glucitol.

56. A polycarbonate, comprising:

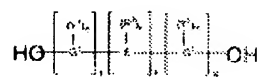
structural units of formula derived from a 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine:



wherein R¹ is selected from the group consisting of a hydrogen and a hydrocarbyl group, and R² is selected from the group consisting of a hydrogen, a hydrocarbyl group, and a halogen; and further wherein the 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine comprises less than or equal to 1,000 parts per million of a 2-hydrocarbyl-3-((4-hydroxyaryl)(2-hydroxyaryl))phthalimidine relative to an overall weight of said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine.

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57. The polycarbonate of Claim 56, further comprising structural units derived from at least one aromatic dihydroxy compound of the formula:



wherein each G^1 is an independently aromatic group; E is selected from the group consisting of an alkylene group, an alkylidene group, a cycloaliphatic group, a sulfur-containing linkage group, a phosphorus-containing linkage group, an ether linkage group, a carbonyl group, a tertiary nitrogen group, and a silicon-containing linkage group; R^1 is a hydrogen or a monovalent hydrocarbyl group each; Y^1 is independently selected from the groups consisting of a monovalent hydrocarbon group, an alkenyl group, an allyl group, a halogen, an oxy group and a nitro group; each m is independently a whole number from zero through the number of positions on each respective G^1 available for substitution; p is a whole number from zero through the number of positions on E available for substitution; t is a natural number greater than or equal to one; s is either zero or one; and u is a whole number.

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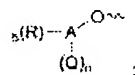
58. The polycarbonate of Claim 57, wherein the at least one aromatic dihydroxy compound is selected from the group consisting of 4,4'-(3,3,5-trimethylcyclohexylidene)diphenol, 4,4'-bis(3,5-dimethyl)diphenol, 1,1-bis(4-hydroxy-3-methylphenyl)cyclohexane, 1,1-bis(4'-hydroxy-3'-methylphenyl)cyclohexane, 4,4'-[1-methyl-4-(1-methylethyl)-1,3-cyclohexandiyl]bisphenol, 4-[1-[3-(4-hydroxyphenyl)-4-methylcyclohexyl]-1-methylethyl]-phenol, 3,8-dihydroxy-5a,10b-diphenylcoumarano-2',3',2,3-coumarane, 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine, 4,4-bis(4-hydroxyphenyl)heptane, 2,4'-dihydroxydiphenylmethane, bis(2-hydroxyphenyl)methane, bis(4-hydroxyphenyl)methane, bis(4-hydroxy-5-nitrophenyl)methane, bis(4-hydroxy-2,6-dimethyl-3-methoxyphenyl)methane, 1,1-bis(4-hydroxyphenyl)ethane, 1,1-bis(4-hydroxy-2-chlorophenyl)ethane, 2,2-bis(4-hydroxyphenyl)propane, 2,2-bis(3-phenyl-4-hydroxyphenyl)propane, 2,2-bis(4-hydroxy-3-methylphenyl)propane, 2,2-bis(4-hydroxy-3-ethylphenyl)propane, 2,2-bis(4-hydroxy-3-isopropylphenyl)propane, 2,2-bis(4-hydroxy-3,5-dimethylphenyl)propane, 2,2-bis(3,5,3',5'-tetrachloro-4,4'-dihydroxyphenyl)propane, bis(4-hydroxyphenyl)cyclohexylmethane, 2,2-bis(4-hydroxyphenyl)-1-phenylpropane, 2,4'-dihydroxyphenyl sulfone, 4,4'-dihydroxydiphenylsulfone, 9,9-bis(4-hydroxyphenyl)fluorene, 4,4'-dihydroxy-1,1'-biphenyl, 2,6-dihydroxy naphthalene; hydroquinone; resorcinol, C₁₋₃ alkyl-substituted resorcinols, 3-(4-hydroxyphenyl)-1,1,3-trimethylindan-5-ol, 1-(4-hydroxyphenyl)-1,3,3-trimethylindan-5-ol, and 2,2,2',2'-tetrahydro-3,3,3',3'-tetramethyl-1,1'-spirobi[1H-indene]-6,6'-diol.

59. The polycarbonate of Claim 56, wherein said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine is 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine.

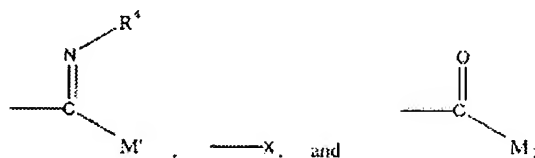
60. The polycarbonate of Claim 56, further comprising at least one end group derived from said activated carbonate.

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61. The polycarbonate of Claim 60, wherein said at least one end group indicative of said activated carbonate has a structure of formula:



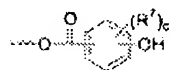
wherein Q is an ortho-positioned activating group; A is an aromatic ring; n is a natural numbers of 1 to the number of replaceable hydrogen groups substituted on the aromatic ring A; R₁ is a substituent group selected from the group consisting of alkyl, cycloalkyl, alkoxy, aryl, cyano, nitro, and halogen; b is a whole number of from 0 to the number of replaceable hydrogen groups on the aromatic ring minus n; and Q is a radical independently selected from the group consisting of (alkoxycarbonyl)aryl groups, halogens, nitro groups, amide groups, sulfone groups, sulfoxide groups, or imine groups with structures



wherein X comprises halogen or NO₂; M and M* independently comprises N-alkyl, N-aryl, or N-alkyl aryl; R⁴ comprises alkyl or aryl when n is 1; and n has a value of 0 or 1.

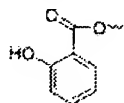
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62. The polycarbonate of Claim 60, wherein said end groups indicative of said activated carbonate comprise end groups has a structure of formula:



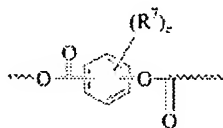
wherein R' is a halogen atom, cyano group, nitro group, $C_1 - C_{20}$ alkyl radical, $C_4 - C_{20}$ cycloalkyl radical, $C_4 - C_{20}$ aromatic radical, $C_1 - C_{20}$ alkoxy radical, $C_4 - C_{20}$ cycloalkoxy radical, $C_4 - C_{20}$ aryloxy radical, $C_1 - C_{20}$ alkylthio radical, $C_4 - C_{20}$ cycloalkylthio radical, $C_4 - C_{20}$ arylthio radical, $C_1 - C_{20}$ alkylsulfinyl radical, $C_4 - C_{20}$ cycloalkylsulfinyl radical, $C_4 - C_{20}$ arylsulfinyl radical, $C_1 - C_{20}$ alkylsulfonyl radical, $C_4 - C_{20}$ cycloalkylsulfonyl radical, $C_4 - C_{20}$ arylsulfonyl radical, $C_1 - C_{20}$ alkoxy carbonyl radical, $C_4 - C_{20}$ cycloalkoxy carbonyl radical, $C_4 - C_{20}$ aryloxy carbonyl radical, $C_1 - C_{60}$ alkylamino radical, $C_4 - C_{60}$ cycloalkylamino radical, $C_1 - C_{60}$ arylamino radical, $C_1 - C_{60}$ alkylaminocarbonyl radical, $C_4 - C_{60}$ cycloalkylaminocarbonyl radical, $C_4 - C_{60}$ arylaminocarbonyl radical, or $C_1 - C_{20}$ acylamino radical; and c is a whole number of 1-4.

63. The polycarbonate of Claim 60, wherein said end groups indicative of said activated carbonate comprises a structure having a formula:



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64. The polycarbonate of Claim 56, further comprising at least one internal ester-carbonate structural unit derived from said activated carbonate, having a formula:



wherein R^7 is a halogen atom, cyano group, nitro group, $C_1 - C_{10}$ alkyl radical, $C_4 - C_{20}$ cycloalkyl radical, $C_4 - C_{20}$ aromatic radical, $C_1 - C_{10}$ alkoxy radical, $C_3 - C_{20}$ cycloalkoxy radical, $C_4 - C_{20}$ aryloxy radical, $C_1 - C_{20}$ alkylthio radical, $C_4 - C_{20}$ cycloalkylthio radical, $C_4 - C_{20}$ arylthio radical, $C_1 - C_{20}$ alkylsulfinyl radical, $C_4 - C_{20}$ cycloalkylsulfinyl radical, $C_4 - C_{20}$ arylsulfinyl radical, $C_1 - C_{20}$ alkylsulfonyl radical, $C_4 - C_{20}$ cycloalkylsulfonyl radical, $C_4 - C_{20}$ arylsulfonyl radical, $C_1 - C_{20}$ alkoxycarbonyl radical, $C_4 - C_{20}$ cycloalkoxycarbonyl radical, $C_4 - C_{20}$ aryloxy carbonyl radical, $C_2 - C_{40}$ alkylamino radical, $C_5 - C_{60}$ cycloalkylamino radical, $C_5 - C_{60}$ arylamino radical, $C_1 - C_{40}$ alkylaminocarbonyl radical, $C_4 - C_{20}$ cycloalkylaminocarbonyl radical, $C_4 - C_{20}$ arylaminocarbonyl radical, or $C_1 - C_{20}$ acylamino radical; and c is a whole number of 1-4.

65. The polycarbonate of Claim 56, wherein said polycarbonate has a yellowness index of less than or equal to about 10, as measured on a 3 millimeter thick plaque in accordance with ASTM D1925.

66. An article comprising the composition of Claim 56.

67. The article of Claim 66, wherein said article has a yellowness index of less than or equal to about 10, as measured on a 3 millimeter thick plaque in accordance with ASTM D1925.

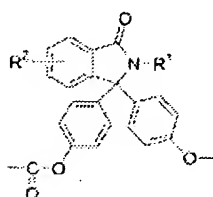
68. The article of Claim 66, wherein said article has a yellowness index of less than or equal to about 2, as measured on a 3 millimeter thick plaque in accordance with ASTM D1925.

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69. The article of Claim 66, comprising a film, a molded article, an automotive headlamp inner lens, an automotive headlamp outer lens, an automotive fog lamp lens, an automotive bezel, a medical device, a display device, an electrical connector, an under the hood automotive part, or a projector lens.

70. A lens comprising a polycarbonate, wherein the polycarbonate comprises:

structural units of formula derived from a 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine:



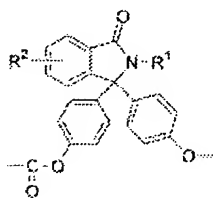
wherein R¹ is selected from the group consisting of a hydrogen and a hydrocarbyl group, and R² is selected from the group consisting of a hydrogen, a hydrocarbyl group, and a halogen; and further wherein the 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine comprises less than or equal to 1,000 parts per million of a 2-hydrocarbyl-3-((4-hydroxyaryl)(2-hydroxyaryl))phthalimidine relative to an overall weight of said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine; and

a yellowness index of less than 10 as measured on a 3 millimeter thick plaque in accordance with ASTM D1925.

71. The lens of Claim 70, wherein said polycarbonate comprises a yellowness index of less than 2 as measured on a 3 millimeter thick plaque in accordance with ASTM D1925.

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72. A polycarbonate copolymer comprising structural units of formula derived from a 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine:



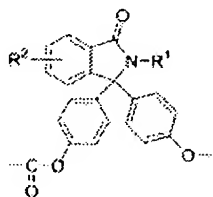
wherein R^1 is selected from the group consisting of a hydrogen and a hydrocarbyl group, and R^2 is selected from the group consisting of a hydrogen, a hydrocarbyl group, and a halogen; and further wherein the 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine comprises less than or equal to 1,000 parts per million of a 2-hydrocarbyl-3-[(4-hydroxyaryl)(2-hydroxyaryl)]phthalimidine relative to an overall weight of said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine;

wherein said polycarbonate copolymer has a yellowness index of less than 10 as measured on a 3 millimeter thick plaque in accordance with ASTM D1925.

73. The polycarbonate copolymer of Claim 72, wherein said polycarbonate copolymer has a yellowness index of less than 10 as measured on a 3 millimeter thick plaque in accordance with ASTM D1925.

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74. A polycarbonate copolymer comprising structural units of formula derived from a 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine:



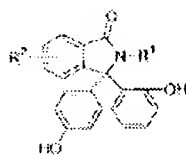
wherein R^1 is selected from the group consisting of a hydrogen and a hydrocarbyl group, and R^2 is selected from the group consisting of a hydrogen, a hydrocarbyl group, and a halogen, wherein the polycarbonate copolymer has a yellowness index of less than 10 as measured on a 3 millimeter thick plaque in accordance with ASTM D1925.

75. The polycarbonate copolymer of Claim 74, wherein said polycarbonate copolymer has a yellowness index of less than 2 as measured on a 3 millimeter thick plaque in accordance with ASTM D1925.

76. (New) A polymer blend consisting essentially of:

a thermoplastic polymer;

and a polymer composition comprising structural units derived from the 2-phenyl-3,3-bis(4-hydroxyphenyl)phthalimidine, wherein the 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine comprises less than or equal to 1,000 parts per million of a 2-hydrocarbyl-3-((4-hydroxyaryl)(2-hydroxyaryl))phthalimidine relative to an overall weight of said 2-hydrocarbyl-3,3-bis(4-hydroxyaryl)phthalimidine, and wherein said 2-hydrocarbyl-3-((4-hydroxyaryl)(2-hydroxyaryl))phthalimidine has a formula of:



wherein R^1 is selected from the group consisting of a hydrogen and a hydrocarbyl group, and R^2 is selected from the group consisting of a hydrogen, a hydrocarbyl group, and a halogen.